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Editorial.—MR. THOS. MEEHAN, in the *Gardener's Monthly* for November, gives a very interesting history of the weeping willow. All sorts of stories about it have found their way into print and it is well to have them corrected.

C. V. NAEGELI, in a recent number (Oct. 14) of the *Botanische Zeitung*, has published a paper on "The Growth of the Starch-grain by Intussusception." It will be read with great interest by all interested in this much vexed question.

DR. DECRESPIGNY, in the last *Science Gossip*, speaking of plants from the Swiss Highlands, says that "Desor reports *Ranunculus glacialis* as growing upon the Schreckhorn at 11,600 feet, *Androsace pennina* at 10,550 feet, and the lichen *Parmelia elegans* on the highest summit at 13,050 feet."

PROF. PFEFFER has published his first volume on the "Physiology of Plants," it being devoted to Stoffwechsel or metabolism. The second volume will be upon "Kraftwechsel," which, Mr. Vines says, is the conversions of latent into kinetic energy and *vice versa* which are involved in the metabolic processes.

A LATE COPY OF NATURE says that Herren Loew and Bokorny find that living protoplasm possesses in an eminent degree the property of reducing the noble metals from solutions, and that this property is lost when death occurs. The discoverers of this fact say: "It may well be inferred that the mysterious phenomenon denoted by the name of 'Life' depends essentially on these reducing atom groups In the present state of science we explain these 'groups in motion,' these springs of life phenomena, as aldehyde groups, but would by no means exclude some different and better mode of explanation."

DR. ARTHUR MINKS is engaged in a most extensive work. Having established, as he announces, the exact line of demarcation between Lichens and Fungi, he proposes to take them up species by species and show the exact position of each, claiming that many so-called fungi will find a resting place among lichens. This book will be issued in yearly parts, each to treat of at least 200 species. The first volume is to appear this month and can be procured from any bookseller in Germany. The decisive characters employed are based upon the thecæ. To quote from the prospectus. "The two organs, the theca of Lichens and that of Fungi, are so essentially different, that they can not properly be compared; for considering their structure and evolution, they with their spores, stand in a more striking contrast than any other in organic nature."

MR. LESTER F. WARD has had a paper published in the proceedings of the Phil. Soc. of Washington entitled "Field and Closet Notes on the Flora of Washington and Vicinity." It is a most exhaustive consideration of the subject and may well serve as a guide in the study of other floras. In a comparison of the flora of 1830 with that of 1880, Mr. Ward makes it appear that over 80 species have actually disappeared from the region in that time, or have become so rare that their stations have not been discovered. If these represent only the observed disappearances, probably the actual number is much greater. A detailed description of localities of special interest to botanists is given and they make one's fingers twitch to be collecting such species as are mentioned. The flowering time of a large number of species has been especially noted as the time in the region studied does not accord with that given in the manuals, being usually several weeks earlier. Second or fall-blooming of vernal species was noted in 17 species, the majority being *Gamopetalæ*. Seven well defined albinos are listed the genera being *Desmodium*, *Liatris*, *Rhododendron*, *Vinca*, *Mertensia*, *Sabbatia* and *Pontederia*. Many tables are given which give statistical views of the Flora from various standpoints. The whole number of species is 1,249, which compares very favorably with the floras of much more extended regions.

DR. WILLIAM SIEMENS during last winter and spring repeated and enlarged upon his experiments of the year before, showing the applications of electric energy to horticulture and agriculture. His previously stated results were largely confirmed, and it seems to be no longer a matter of doubt that electricity will become as important a factor in horticulture as heat and water, whenever its production can be made reasonably cheap. The favorable effect of continuous light is re-affirmed, and plants seem to be able to work unceasingly and the beautiful nyctitropic actions, so elaborately worked out by Dr. Darwin, are more from the absence of light than from the need of rest, and might well be dispensed with if light could be supplied uninterruptedly. Thus development from "the early leaf to the ripened fruit" can go on at a greatly accelerated pace, and not only will the resulting seeds not lose any germinating power but the fruit will gain in size, aroma and color.

PROF. W. J. BEAL has just published an excellent lecture upon "The New Botany," being a consideration of the best method of teaching. The lecture is one that should be in the hands of every teacher of botany, so full is it of suggestions that can be acted upon, even by those who have no laboratory appliances. The whole effort of the method given is to cultivate in the pupil just what many of us have long been struggling after, namely, the ability for original research. No matter what method of teaching botany is employed, if it teaches and stimulates the pupil to observe, it is based upon the correct principle. There may be as many ways of gaining this end as there are good teachers, and every true teacher will leave his own impress upon the method employed. But those who can not originate methods, had better follow

those that have proved most successful, and looking at results, there are few better teachers of botany than Prof. Beal. But he speaks for himself upon another page and gives us not only a synopsis of his own methods, but, what is perhaps just as interesting, a specimen of what they produce.

EVER SINCE INSECTIVOROUS PLANTS came into vogue there has been no end of plant marvels. That wonderful tropical tree which swallowed into its leafy crown any unlucky mortal who came within the circle of its influence has run the gauntlet of the newspapers more than once, but really it represented very wel la Broddignagian *Drosera*. The latest phase of this multiform story has just appeared in the pages of a scientific periodical where it is published as credible. It comes this time dignified by the names of officers of the royal navy, and the appetite of the tree has become most abnormal, desiring now only bones which it holds on to with all the pertinacity of a famished dog. The tree observed had the habit of passing the bones tossed under it up to its upper braches, and standing near some native huts every twig was ornamented with its set of bones, the natives evidently not considering it so much of a curiosity as a convenient receptacle for bone rubbish. Indeed, this last story seems not to have lost a whit of the marvels of the first, and its appearance in a prominent scientific journal will give it a fine start in the unscientific press.

The Asparagus for Histological Study.—I have for several years been wanting a good Monocotyledon for histological study in the botanical laboratory, one which should be for its sub class what the pumpkin is for the Dicotyledons. The Indian Corn, which is commonly used, is too difficult, and too greatly specialized a type, exhibiting as it does the peculiar nodal structure of the stem of the Gramineæ, rather than the structure of the stem of Monocotyledons in general. A good representative stem, and one which can be obtained everywhere in good condition, from early spring until the end of the season, is the Asparagus. This has been carefully studied the past season in the botanical laboratory of the Iowa Agricultural College, by Miss Fannie J. Perrett, from whose thesis I select the following results:

The epidermis is composed of elongated cells quite regular in outline, and of deep radial, as compared with tangential diameter. The external walls are well thickened. The stomata are abundant, and are regularly disposed. They appear to develop directly from mother-cells cut off by transverse fission from the ends of ordinary cells. It is an easy matter to secure transverse sections of stomata by making repeated cross sections of the stem. Trichomes appear to be wanting.

The hypoderma is composed of collenchyma and parenchyma, the latter being rich in chlorophyll Beneath the hypodermal tract is a meristem layer, to be more particularly noticed hereafter. The remainder of the Fundamental System of tissues is composed of large and long-celled parenchyma.

The fibro-vascular bundles are closed; that is, they contain, when fully developed, no meristem tissue. In a transverse section

each bundle consists of a V-shaped mass of tracheary tissue, including spiral, reticulated and pitted vessels, the last mentioned occupying the upper parts of the arms of the V, others lying towards its point. The cavity of the V, which looks toward the periphery of the stem, contains a poorly developed sieve tissue. Small-celled parenchyma on its peripheral and lateral surfaces, and a varying amount of fibrous tissue, mostly in connection with the tracheary tissue, complete the structural elements of the bundle.

In the meristem layer mentioned above, new bundles arise, and thus increase the stem in a sort of exogenous manner, as is done in the Dragon trees and other tree-Liliaceæ. This feature alone in the structure of the Asparagus stem makes it an exceedingly valuable one for study, as bundles of all ages may readily be obtained in the same section.

In the stem at the base of each leaf, those ascending bundles which are connected with the fibro-vascular system of the leaf, divide into four branches, two of which continue upward through the stem, while two pass outward into the leaf. In each bundle, the ascending cauline portions unite right and left with corresponding portions of the adjacent bundles, while in a similar manner those which pass into the leaf unite right and left, and form the principal leaf veins. The bundles in the stem which connect with the fibro-vascular system of the lateral stems (branches) divide at the baseof the latter into two parts, which unite right and left and thus form the bundles of the lateral stem. A few of the branch-bundles have a deep connection in the stem with bundles which have also an upward cauline extension.

It must not be forgotten that the leaves of the Asparagus are quite small, flat, triangular, bract-like structures, and that the needle-shaped bodies which constitute the so-called leaves, are in reality short, leafless, lateral stems.—C. E. Bessey, *Ames, Iowa.*

An Interesting Fernery.—My attention having been called to some ferns growing in the crevices of the north wall of the old Mass. State Prison in Charlestown, (no longer used as a prison) by Mr. C. E. Perkins of Somerville, on examination I found four species which I have identified as *Asplenium Filix-fœmina*, *Dicksonia pilosiuscula*, *Aspidium Thelypteris* and a form of *Aspidium spinulosum.*

The plants, with the exception of one growing high up beyond my reach, but the fronds of which I afterward obtained with the aid of a long pole and found to be a well fruited specimen of *A. Filix-fœmina*, were, as might be expected in such a situation, merely depauperate forms and mostly sterile.

I collected a few fertile fronds of *A. Filix-fœmina* that might very well pass for "*var. exile*," some of them not more than 4 or 5 inches tall and sparing, one or two quite well pointed.

The other species were all sterile, and the specimens, except those of *A. spinulosum*, were not at first clearly distinguishable being small

and considerably changed in appearance by growing in such uncomfortably cramped quarters.

As none of these ferns, nor any others for that matter so far as I know, grow anywhere near the Prison grounds naturally, their presence in such an unnatural situation is not easily accounted for, but it is to be presumed that the spores were blown from a distance by high winds and lodged in the crevices where they subsequently found sufficent moisture and shelter to favor their germination.

The territory immediately surrounding this portion of the Prison wall at present (originally partly surrounded by water) is made of low filled land partially covered with coarse plants, which I had no time to examine, but conspicuous among which, and abundant, was *Senecio vulgaris*, and, judging from the number of burrs attached to my clothing when I came off the ground, *Lappa officinalis*.

The ground still retains much of its original dampness, and this, together with the condensation of escaping steam from the manufactory adjoining the wall within the Prison yard, assists the heavy granite wall in condensing and holding moisture enough to sustain quite a vegetable colony, other plants besides ferns being found there.

Some of the upper cracks had become sufficiently widened by the crumbling away of the mortar to effectually hide and protect the sparrows that flew in and out above my head, and this may have led one near by to suggest that the *seeds of the ferns had probably been carried there by the birds*!

The rootstocks of *A. Thelypteris* and *Dicksonia* had receded to quite a depth, while the crowns of the others were about even with the wall.

I brought away a few plants that I succeeded, with some difficulty, in getting out of the cracks, and also *Marchantia polymorpha* that was growing with them, and these I have set out in a moist ravine where I can watch their future development under more natural conditions.

Mr. Perkins, who has botanized quite extensively about waste grounds, and is familiar with all such places in this vicinity, writes me that he saw one season a large fern clump growing on one of the wharves in the Charlestown Navy Yard partly under the beams, and mentions some ice-houses with ferns growing from the cracks between the boards, but the latter are in close proximity to fronds whose ferns abound naturally.—GEO. E. DAVENPORT.

Some New Grasses.—MELICA HALLII, n. sp.,—Culms wiry, erect, 1½ to 2 feet high. Leaves all involute, setaceous, scabrous; the radical numerous, 5 to 12 inches long, those of the culm (about two) 1 to 1½ inches long, ligule obsolete. Panicle narrow, 2 to 3 inches long, the branches solitary or in pairs, the longest 1½ to 2 inches, the 3 to 5 spikelets borne above the middle. Spikelets 3 to 4 lines long, two-flowered with a distinct rudiment of a third; outer or empty glumes membranaceous, equalling the flower, lanceolate, acute, the upper a little the longer, midvein prominent, the lateral nerves soon evanescent or wholly wanting; flowering glumes and palets chartaceous, finely scabrous, about equal, the flowering glume 3–5-

nerved, the midnerve terminating in a short, stiff mucro, the palet strongly 2-nerved and bifid or 2-cleft at the apex. Stipe of the second flower about half a line long.

This I have received from Mr. J. Macoun, collected three different seasons on the Great Plains of British America. It is also the No. 621 of Hall and Harbour's Colorado collection.

SPOROBOLUS JONESII, n. sp.,—Culms densely tufted, erect, 1 to 1½ ft. high, wiry; radical leaves numerous, short, rigid and involute, except the lowest; culm with 1 or 2 leaves below, the blade about 1 inch long, setaceous, sheath four times as long, scabrous. Panicle erect, thin, 1½ to 3 inches long, rays solitary, appressed, the lower 1 to 1½ inches long, subdivided from the lower third; spikelets mostly very short pedicelled, about 1½ lines long; glumes about ⅓ as long as the flower, broad, obtuse or truncate, and the apex erosely toothed, thin and purplish; flower with a distinct pedicel or callus, the flowering glume and palet much alike in texture, firmly membranaceous, 1 nerved, finely scabrous and slightly pubescent below, 1 to 1½ lines long, the palet narrower and but little shorter, after flowering becoming more elongated, cylindrical and pointed.

Collected by Prof. M. E. Jones at Soda Springs, Cal.

POA PURPURASCENS, n. sp.—Culms erect, 1 to 1½ feet high, smooth; cauline leaves mostly 2, the lower ones 2 or 3 inches above the base, the upper with a long sheath running above the middle of the culm, blade flat, 2 to 3 inches long, thickish, pungently pointed, 1½ lines wide, ligule about 2 lines long, membranaceous, entire or incised, sheath and blade glabrous; panicle erect, oblong or pyramidal when expanded, 2 to 3 inches long, rays in twos or threes, single above, an inch long or less, mostly flowering above the middle, each with, usually, 2 or 3 spikelets. Rachis, rays and pedicels glabrous. Spikelets ovate, about 4 lines long, short pedicelled, 3 to 5 flowered; outer glumes broadly scarious margined, the lower about 2 lines long, ovate-lanceolate, acute, the upper a little longer and wider with the apex coarsely toothed, or entire and acute, 3 nerved at the base; flowering glumes 3 lines long, lanceolate, compressed, with a wide scarious and purplish margin and apex, sometimes lacerate toothed, mostly acute, the lower part green, minutely scabrous, and near the base pubescent or villous: palet a little shorter, narrow, 2 keeled, scarious and colored at the apex. Panicle and lower leaves and sheaths purplish.

Collected by Mr. Howell on Mt. Hood, where it was also collected by Mr. E. Hall, Oregon Coll. No. 633. It has also been collected in the Yellowstone region.

Mr. Howell's collection contains specimens of the grass which has been called *Poa*, and more recently *Atropis*, *Californica*. In the Botany of California the genus *Atropis* is made to include not only several species which have been classed in *Glyceria* and *Sclerochloa*, viz: *Glyceria distans*, *tenuiflora*, *convoluta*, *airoides*, *maritima* and *procumbens*, but also Mr. Nuttall's two species *Poa tenuiflora* and *P. Andina*, as well as two species described there for the first time. Any one acquainted with these grasses will perceive that in order

to bring them together considerable modification of the characters of the genus *Sclerochloa* of Beauv. and of *Atropis* as defined by Trinius must be effected. Inded I do not think this can be accomplished with reference to Nuttall's *Poa Andina* without separating from *Poa* a species which as naturally belongs there as does *P. alpina*. With respect to the plant generally known as *Poa tenuifolia*, Nutt., especially if we include the larger California forms there is a wonderful variation in nearly all the characters usually defined in the limitation of a species, namely, in the height of culms, the length and rigidity of leaves, both radical and cauline, the size of ligule, the size and form of panicle, the length and spread of the rays, and to some extent in the size and form of the flowering parts. From a very careful study of hundreds of specimens I conclude that this species or group of species is essentially characterized by linear, linear-oblong or linear-lanceolate flowering glumes, of a hard or firm texture, minutely scabrous, convex or rounded on the back, and with the apex and more or less of the margins scarious and peculiarly tinged with a yellowish bronze color. The apex of the flowering glume may be acute or obtuse, entire or erose. In *Poa Andina*, Nutt., as I understand that species, the flowering glumes are broader, generally thinner in texture, less scabrous, smooth or softly and sparsely pubescent, keeled and generally much compressed, in some forms quite as much compressed as in *Poa alpina*.

Usually *Poa tenuifolia*, has *long*, *narrow* outer glumes, sometimes quite equalling the flowering ones in length; usually *Poa Andina* has shorter and broader outer glumes. In my consideration of *tenuifolia* I have included the large California forms, one of which I some years ago described as *Festuca Oregona*, (see BOT. GAZETTE for August 1877) and which I now return to *Atropis Californica* on the authority of Gen'l Munro, to whom I sent specimens which were returned to me with his name as above and with synonym *Sclerochloa Californica*, Munro in Pl. Hartw. I particularly state this because in the Botany of California, Gen'l Munro's name is applied to the *Poa Andina*, Nutt. It is not probable that Gen'l Munro has seen all the forms of the two plants, but in view of their variability he may have even confounded the two. In the species, or group of species, which I have taken for *Poa tenuifolia*, Nutt., or *Atropis Californica*, Munro, there is such a perplexing variety of forms that it may well be conjectured that Nature is now engaged in the work of differentiation, and that in process of time the lines will become more sharply defined and several new species established.

GEO. VASEY.

Systematic Botany Nevertheless.—

"The reason why I can not tell,
But this alone I know full well,
I do not like you, Dr. Fell."

And here the average amateur, interested in his local flora, and fond of dabbling a little in systematic botany, had better, perhaps, take his stand, when urged to study vegetable histology and physiology instead. And yet, when you find that a very large proportion of those who constitute the purchasers of botanical books (a very useful

class to the Big-wigs) and the subscribers to botanical periodicals (use understood) are interested in plants themselves, and not in their "Latin parts"—parenchyma, collenchyma, sclerenchyma and all the rest—interested in their structural affinities as expressed in a methodical arrangement, in their geographical distribution and antecedents, there must be some reason for it. For ever since the day when some of us pulled through the first two hundred pages of the earlier edition of Gray's Text book (if the "term" had been longer we might have gone further with our memorized recitations) down to the present era of Summer Schools all given over to the study of protoplasm, we have had class after class ground through this course of Histology, rarely under the most efficient guidance, and oh! how abundantly under the perfunctory charge of the average High School teacher, and as a patent commentary on the outcome of it all the editor of this delightful GAZETTE of ours asking the "physiological botanists of this country" to take in a "hearty way" "half of its space," but they "are either few in number" or else "do not record their investigations." Meanwhile systematic botany, *practically* ignored in our schools, (I measure my words and speak from a tolerably extended observation) needs no noise of the "recruiting sergeant" to keep its ranks full! Prof. Morse in his charming preface to the "First Book of Zoology" says,—"to collect in the field, to make a cabinet, and then to examine and study the specimens collected are the three stages that naturalists, with few exceptions, have passed through in their boyhood." "The way to commence the study of Zoology (and Botany as well) is to follow the course one naturally pursues when he is led to the study by predisposition." I have not a word in disparagement of the importance of histological studies, nor of the interest that may be found therein by persons who have an aptitude for such investigations. What I do protest against is the way in which Histology is thrust upon students as *the only* foundation for a fair knowledge of systematic botany. It is assumed that a course of nice, microscopical work in cell structure is a capital preparation for the enjoyment which the average amateur seeks to find in the study of plants. This I am willing to half admit but, oh! the unutterable stupidity of simply memorizing the account of it all which is the fate of ninety-nine out of one hundred of the students who will "take botany" in their course "next term."*

After all, the choice is a matter of predilection. From the amateurs like John Stuart Mill and Charles Kingsley—men of transcendent ability, who seek in the amiable science recreation for a summer's vacation, or an occasional holiday, down to the young man or young woman of the obscure village, who is striving to keep mind and heart sweet and pure by "considering the lilies of the field" (I concede my physiological friend that the rest of the quotation is against me) it is a noticeable fact that systematic botany has the preference There is a hearty enthusiasm among field workers which is infectious; a generosity in sharing spoils which makes "a good find" half a disappoint-

* "The system I repudiate is that which allows teachers who have not come into direct contact with the leading facts of a science to pass their second-hand information on."—*Huxley*.

ment withal if there are not specimens enough to go 'round; and all this leads to correspondence, and thus furnishes the "key to the intercourse of most amiable minds." "To botany," says Sir James E. Smith in a letter to the Rev. Dr. Muhlenberg, "I owe friendships and connexions I else could have had no chance of forming."

An argument brought forward by your excellent contributor, Prof. Rothrock, is in effect (I quote from memory) that Torrey and Gray, Engelmann and Watson have so worked up *for good* our North American Flora that there is nothing worth considering left to be done in that direction by their successors. The introduction of Mr. Sereno Watson's name, most appropriate as a matter of fact, is unfortunate for the argument. How many of us knew of Mr. Watson even by name before the publication of the "Botany of the 40th parallel" and since that time how he has been straightening out *Lupinus*, *Œnothera* and *Potentilla* and our Chenopods, &c., eliminating right under our very noses such species as *Ranunculus ambigens* and *Polygonum Muhlenbergii*, while the rest of us might have drifted along under a hazy impression that Torrey and Gray and Engelmann had worked that ground all over and there was nothing left worth gleaning. Just think how the Flora of the British Islands has been elaborated, and with what sustained enthusiasm it is still studied! What works of supererogation, pure and simple, are Bentham's "Hand Book" and Hooker's "Student's Flora" if we are to accept the view that the dictum of any systematist, no matter what his rank, is final. Again who is to be the botanical geographer of the American Flora as the recently deceased Hewit C. Watson was of the British, above all who is to collect the data upon which his generalizations are to rest!

I fear our friend Dr. Rothrock is indulging in a bit of covert flattery when he tells us to find encouragement in what Darwin got out of the study *Drosera*. Do we not all know too well that back of Darwin's brilliant success lies a sagacity in questioning nature and in appreciating the full significance of the response wholly phenomenal, and that one of us might make and write down observations for a lifetime, as utterly barren of important result as an undigested weather record.

But there is room for all. We need not crowd or jostle each other. Only let us hope that when Prof. Rothrock comes to establish that School of Botany for which he is so well equipped, not only by training at home and abroad, but that rarer qualification, personal magnetism, that he will make the critical study of a few forms but the first step toward the comparative study of many forms. The description of *a plant* with some such facile help as a printed schedule affords is one thing, the description of *a species* flexible enough to include varying forms is, so far as the exercise of one's wits is concerned, quite another thing, and the study of species in groups, discriminating for one's self without hint or help from those who have gone over the ground before, *this* has in it an educational value of the highest import, and prepares the student for much critical and independent work a field which yet remains to be done in our home flora.

— EMESBY.

A Comparative View of the Flora of Indiana.—A recent paper by Mr. Lester F. Ward, entitled "Field and Closet Notes on the Flora of Washington and Vicinity," has suggested the filling in of some of his tables with similar statements in regard to the flora of Indiana. I use, without verification, Mr. Ward's estimates of the flora of the Eastern United States, being the region covered by the Manuals of Drs. Gray and Chapman, and give in the first table the sixteen largest orders in the Flora of Washington and vicinity, in the flora of the Eastern United States, and in the flora of Indiana, the sixteen being arranged in the order of their importance. For convenience, Mr. Ward's list will be headed D. C.:

D. C.	*E. U. S.*	*Ind.*
1. Compositæ	1. Compositæ	1. Compositæ
2. Gramineæ	2. Cyperaceæ	2. Cyperaceæ
3. Cyperaceæ	3. Gramineæ	3. Gramineæ
4. Leguminosæ	4. Leguminosæ	4. Leguminosæ
5. Rosaceæ	5. Filices	5. Labiatæ
6. Labiatæ	6. Labiatæ	6. Rosaceæ
7. Cruciferæ	7. Rosaceæ	7. Scrophulariaceæ
8. Scrophulariaceæ	8. Scrophulariaceæ	8. Liliaceæ
9. Filices	9. Ericaceæ	9. Filices
10. Ranunculaceæ	10. Liliaceæ	10. Ranunculaceæ
11. Ericaceæ	11. Ranunculaceæ	11. Cruciferæ
12. Cupuliferæ	12. Cruciferæ	12. Orchidaceæ
13. Orchidaceæ	13. Orchidaceæ	13. Polygonaceæ
14. Liliaceæ	14. Umbelliferæ	14. Umbelliferæ
15. Polygonaceæ	15. Polygonaceæ	15. Caryophyllaceæ
16. Umbelliferæ	16. Cupuliferæ	16. Ericaceæ

It will thus be seen that the flora of Indiana is more normal than that near Washington, and that, omitting the *Filices* and *Ericaceæ* (our most poverty stricken orders) the second and third lists correspond with great exactness. These lists alone would indicate some unusual conditions in the vicinity of Washington, and such we find in the blending of the floras of north and south, as indicated by Mr. Ward. In comparing the first list with the third we notice that the *Liliaceæ* rise from the 14th place to the 8th, the *Cupuliferæ* drop out entirely, being the 17th in order of importance; the *Caryophyllaceæ* come into the first 16; and the *Ericaceæ* drop from the 11th place to the 16th. Mr. Ward shows that his local flora is richest proportionally in the *Cupuliferæ*, *Rosaceæ* and *Cruciferæ*, and poorest in the *Filices* and *Leguminosæ*. The *Cupuliferæ*, in fact, form the greatest peculiarity of the flora, containing as many as 58 per cent. of the species occurring in the whole of the Eastern part of the United States. The Indiana flora, compared with the same standard, is richest in the *Rosaceæ*, *Polygonaceæ* and *Cupuliferæ*, but none of them so abnormally represented as the *Cupuliferæ* near Washington, the *Rosaceæ* rising to but 48 per cent. The abundant *Cruciferæ* of Mr. Ward's list, in Indiana yield in importance to the *Liliaceæ*, *Ranunculaceæ* and *Labiatæ*, and just equal the *Orchidaceæ*. The Indiana flora is proportionally poorest in the *Filices* and *Ericaceæ*.

Comparing the 15 large genera listed by Mr. Ward with the

same number found in the Indiana flora, and arranging as before in the order of importance, the result is as follows.

D. C.	*Ind.*
1. Carex	1. Carex
2. Aster	2. Solidago
3. Panicum	3. Aster
4. Solidago	4. Polygonum
5. Quercus	5. Viola
6. Polygonum	6. Quercus
7. Desmodium	7. Desmodium
8. Salix	8. Helianthus
9. Juncus	9. Salix
10. Viola	10. Juncus
11. Cyperus	11. Panicum
12. Ranunculus	12. Ranunculus
13. Eupatorium	13. Euphorbia
14. Helianthus	14. Cyperus and Potamogeton
15. Asclepias	15. Galium and Scirpus

It will be noted that in the second list *Eupatorium* drops out, appearing in the Indiana flora as No. 25; *Asclepias* also drops out, being No. 20; *Panicum* drops from 3 to 11, and *Viola* rises from 9 to 5. It would seem that *Panicum* is the characteristic genus of the vicinity of Washington, while no single genus can be so ranked in the flora of Indiana, *Helianthus*, *Euphorbia*, *Viola* and several others being equally characteristic.—J. M. C.

Beginning Botany.—I want to tell you a little about my mode of teaching botany to beginners. Before long I will send you a copy of a lecture on this subject.

I set a student on the very start to studying some natural object, as a plant, a seed, a flower, a vine. He is asked to state to the class on the following day what he has discovered. One of the first points is to teach him to see and to become reliable and independent. To acquire this habit he is set to looking. To help him he is often asked to compare two branches of different trees, or two flowers of different species or genera, or two seeds or fruits.

I require students to write out more or less their observations. For this work credit is given, as well as for class recitations. This is not only done in the botany class, but our Professor of the English language, finds such topics among the best he can select for the practice of young students. Many of the essays required are accompanied by drawings which help to explain certain points. As an example of this work, I send a short paper prepared by a member of the Freshman class. It must be remembered that he is a beginner; that he used no books, but went to the plants to get his facts. He had been studying plants for a few weeks. He had been referred to an elementary book for some names. He had received some hints on some points from his teacher while in the class room. Of course, he picked up more or less from his classmates during recitations, in which they spoke of kindred topics:

THE FERTILIZATION OF THE TRUMPET-CREEPER, BY GEORGE SPRANG.—In the bud the calyx of the Trumpet-Creeper is valvate and encloses the other

organs of the flower; the corolla is deeply imbricated, and covers the stamens and pistil.

The anthers of the young flower are very large and of a bright yellow; they are composed of two mealy sacks which are slightly attached together and fall back and nearly cover the filament.

As the flower grows and becomes larger, the anthers become smaller until they are only about one-third of their original size.

In the bud the pistil is already quite tall and has to take a stooping position, but when the flower grows and opens the pistil takes an upright position and always keeps above and out of the reach of the stamens.

Most flowers require crossing, and the arrangement of most of them is such as to prevent self-fertilization and to insure crossing.

The above example is the most common mode by which self-fertilization is prevented, but this plant has other and more striking illustrations of this fact.

The stigma is two-lobed and is so sensitive that if anything touches it, it immediately closes, hence, when the Humming-bird, the principal means by which this plant is fertilized, hovers over the flower and sticks its long proboscis down into the tube its head touches these lobes and they close almost immediately and remain so for a short time.

The anther cells are now open and ready to shed pollen, and as the bird puts its head further down into the tube, it hits these cells and the pollen is dusted upon it, and flying back it hits the pistil again but the stigma is closed and none of the pollen can get in.

But when it goes into the next flower the stigma is open and the pollen is shed upon its lips, sometimes so much as to be plainly seen by the naked eye.

This process is repeated till the bird, tired of the meagre amount of honey it gets for is labors, flies to some other plant hoping for better success.

This plant has an enemy in the black ant which does not enter the flower at the mouth, but eats through the calyx and corolla and sucks the honey which is laid up for the attraction of the birds. Even if the ant did enter at the top and get pollen upon it, it would immediately fall off from its smooth body and legs and thus use up the pollen which would be of no use to the plant in its fertilization.

But the plant's bright and gaudy corolla attracts the birds and even if one does not enter more than two or three flowers, yet it enters enough to scatter the pollen on some pistil and fertilize it.

It has often seemed to me that scientific magazines did not pay enough attention to the best modes of teaching science.

PROF. W. J. BEAL,
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Quercus heterophylla, Michx.—This tree which for so many years was comparatively unknown, now has its history very well written, yet the number of trees known are very few, and their scarcity has prevented the examination of the wood heretofore, perhaps entirely. The appointment of Prof. Sargent on the department of Forestry in the Census Bureau, has led to the examination of all the species of forest trees in the United States that could be procured. For this purpose I secured a tree of this species, found growing near Mount Holly, Burlington Co., New Jersey, and forwarded to him such portions as he desired; there yet remain in my possession several sections, which I have thought might be desirable for museums and private collections, where specimens of our native woods are kept. I will forward to each as may apply a specimen of this Bartram Oak upon being informed of the dimensions desired.—ISAAC C. MARTINDALE, *Camden, N. J.*